First meeting of the sPHENIX Quarkonia Topical Group

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SPHENIX Quarkonia Topical Group

Immediate collaboration wide goal: Meet the ALD's charge to sPHENIX

Performance for Upsilons vs detector scope
- Momentum/mass resolution
- Efficiency
- Signal/background

Evaluate using (realistic as possible) cylinder cell geometry in G4 for:
- Pixel inner tracker + silicon strip detector
- Pixel inner tracker + TPC (+ intermediate tracker?)
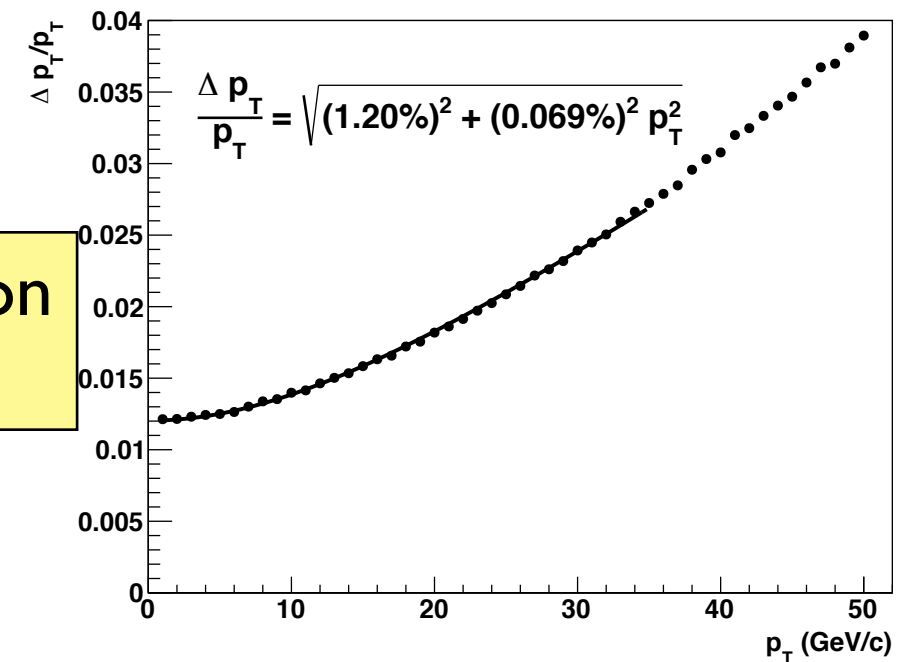 - Repeat with Pixels replaced with a MAPS inner tracker.

Our goal is to understand the sPHENIX detector performance for the Upsilon measurement for all tracking configurations that are being seriously considered.

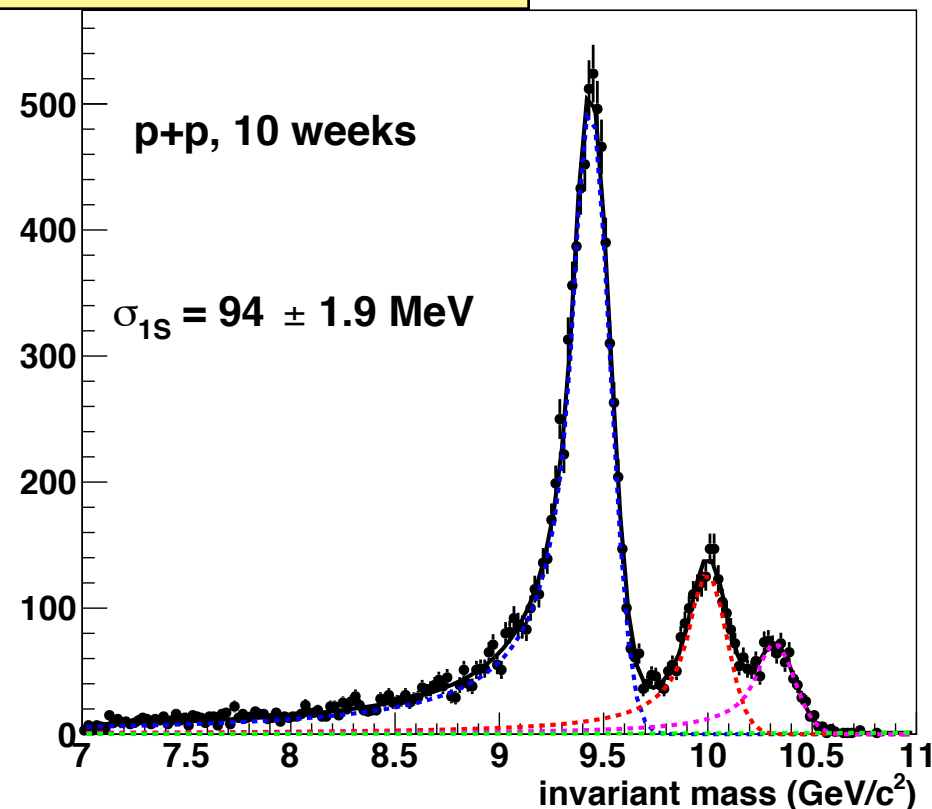# What we have shown in public - silicon strip tracker

Assume (for the moment) 100% live pixels
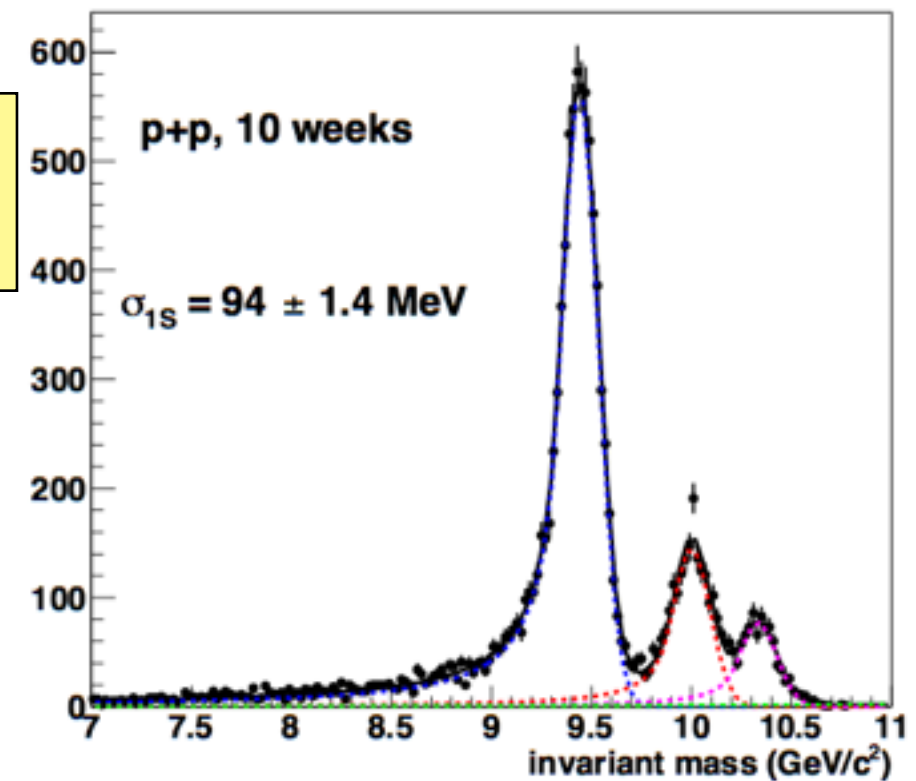- Single pion p_T resolution
- Upsilon mass resolution

single pion p_T resolution
(either pixel option)

$$\frac{\Delta\ p_T}{p_T} = \sqrt{(1.20\%)^2 + (0.069\%)^2\ p_T^2}$$

Reused PHENIX pixels

p+p, 10 weeks

σ_{1S} = 94 ± 1.9 MeV

3 layer MAPS Pixels

p+p, 10 weeks

σ_{1S} = 94 ± 1.4 MeV

What we have shown in public - silicon strip tracker

What is (most) unrealistic about the silicon strip tracker simulations?

The reused PHENIX pixels were assumed perfect
In reality the pixels have large dead areas
  • The design has ~ 87% live area
  • Layer 1 has ~ 92.5% working pixels in PHENIX
  • Layer 2 has ~ 72.5% working pixels in PHENIX

The Silicon strips were assumed to read out every strip
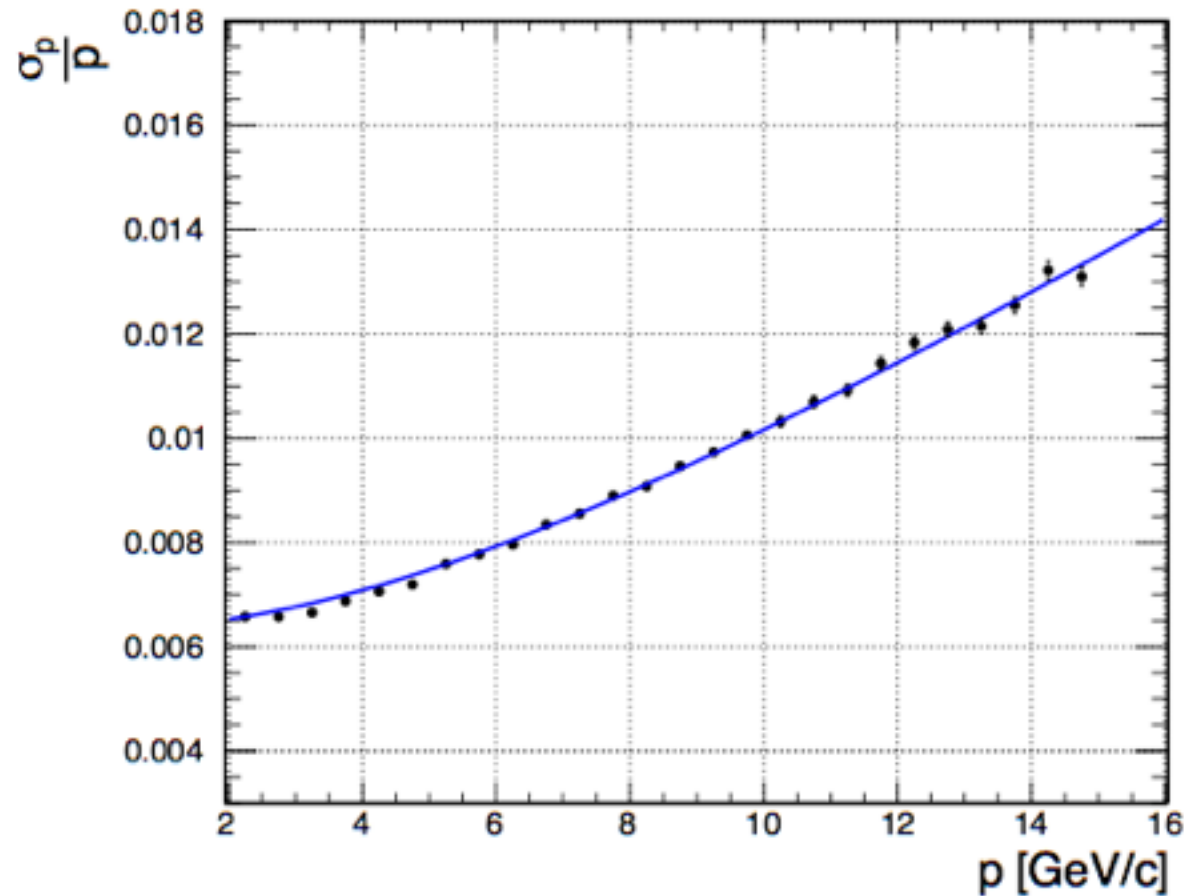In reality, some strips have to be ganged to gather in readout
  • in the middle tracking layers 3 strips have to be ganged
  • In the outer layer 6 strips have to be ganged

We need to understand what effect including these realities would have
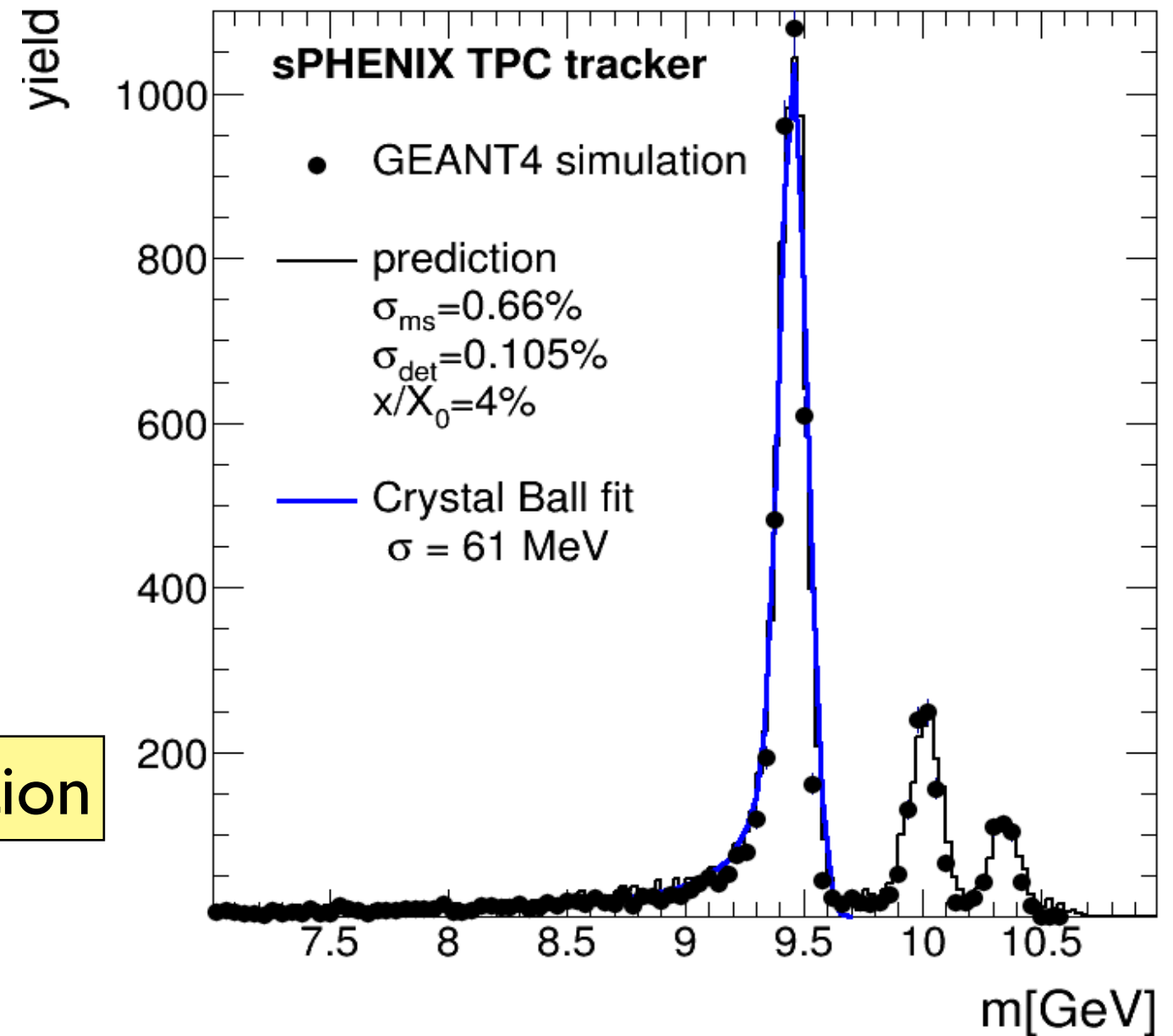one the Upsilon measurement

What we have shown in public - TPC

What we have shown in public - TPC

What is (most) unrealistic about the TPC tracker simulations?

The effect of momentum smearing due to space charge effects in the TPC have not been considered

Tracking performance of the TPC in central Au+Au collisions has not been investigated very well
  • Tracking efficiency, fake rates
  • The ability of the TPC to connect tracks to the inner silicon for central Au+Au collisions has not been investigated

These are all critical needs if we want to claim that we understand how the TPC would perform

The big tasks

1) Somewhat realistic tracking for the TPC in a Hijing event
   - Implies space charge distortions, including fluctuations in space charge
   - How to include event pileup?

2) Match to EMCal and effect on backgrounds

3) Realistic background estimates in mass spectrum
   - Embed electrons in Hijing events and extract hadron rejection vs eta with full tracking with the proposed confifguration